GILBERT TANK FARM - PARCEL 472
BROWNFIELDS ASSESSMENT

Havre de Grace, Maryland
December 1997

Prepared by: Maryland Department of the Environment
Waste Management Administration
Environmental Restoration and Redevelopment Program
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GILBERT TANK FARM - PARCEL 472

AUTHORIZATION

The Maryland Department of the Environment, Waste Management Administration (MDE/WAS), performed an assessment of the Gilbert Tank Farm - Parcel 472 property as part of the Brownfields Initiative. This assessment was completed under the 1997 Cooperative Agreement between MDE and the U.S. Environmental Protection Agency (EPA).

SCOPE OF WORK

This assessment addresses environmental issues that may be a concern under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Data have been compiled from previous studies as well as recent interviews and sampling events. Additionally, non-CERCLA contaminant issues (petroleum products) that were discovered during this investigation have been summarized in this assessment and subsequently referred to MDE's Oil Control Program.

SITE DESCRIPTION

Parcel 472 is a 1.33 acre vacant lot located in Havre de Grace, Harford County, Maryland (Figures 1 and 2). The Susquehanna River borders the site to the north. The property is fenced and bordered on the south by Water Street and the east by public property. An abandoned brick garage building that was part of a former gas station operation remains on the site.

OWNERSHIP HISTORY

J. Lawson Gilbert Distributor, Inc. purchased parcel 472 in May 1966 by from Thomas O. Blackson and Mildred A. Blackson. The Blacksons purchased the property from the Esso Standard Oil Company, a Delaware Corporation (formerly Standard Oil Company of New Jersey) in January 1956. Esso Standard Oil purchased the property from John Russell in September 1918. John Russell purchased the property from Jesse Hillis, Mary Hillis, William L. Conyngham, and Olivia H. Conyngham in November 1907.

PREVIOUS STUDIES/SITE HISTORY

Parcel 472 as well as Parcel 463 were Bulk Plant Transfer Stations for Gulf Oil. MDE's Oil Control Program has records on Parcel 463 (referred to as Cluster #1) and Parcel 472 (referred to as Cluster #2). The files indicate that on December 1, 1972 a complaint was issued concerning an oil slick in the Susquehanna River originating from the bulk plant transfer station.

In December 1972, J. Lawson Gilbert Distributor, Inc. applied for an Oil Handler's Permit to the State of Maryland, Department of Natural Resources, Water Resources Administration (DNR/WRA). On July 23, 1973, a representative from the WRA's Water Quality Permits section inspected the site. The inspection revealed that: 1) the area under the transfer pumps needed to be cleaned and a pad installed, and 2) the barge underloading drip pan needed a cover. DNR requested a compliance plan from the site on July 25, 1973. An Oil Handler's Permit was issued on September 27, 1973 with an expiration date of September 27, 1978. Special conditions noted in the permit included corrective actions of problems noted in the July 25, 1973 report and the requirement to record oil level measurements prior to filling any of the tanks.

In October 1973 J. Lawson Gilbert, Distributor, Inc. applied for an Oil Vehicle Operator's Certificate. The Oil Vehicle Operator's Certificate was updated in March 1975 and in January 1977.

A Field Investigations Report completed by a Water Resources Investigator on March 10, 1975 noted oil in the effluent pump. Mr. Gilbert stated that a hole in the separator was repaired but oil was still entering the final effluent sump. Subsequent field investigation reports noted no problems.

Oil Operation Permits were issued to Gilbert Enterprises (formerly J. Lawson Gilbert, Distributor, Inc.) in 1978, 1983, 1988 and 1994. One driver violation was noted in the file. A spill was reported on September 24, 1979 that involved kerosene. The 10,000-gallon spill was reportedly cleaned up.

In March 1985 Gilbert Enterprises was informed that the diked area was unacceptable as an infiltration basin. In April 1985 Gilbert informed the Oil Control Division of DNR that the abandoned tank farm area was being used as the filtration site for the separator drainage.

Reports of Observations and Oil Facility Inspection Reports from 1988 through 1991 noted unsatisfactory records and reports from the facility as well as storage of batteries, oils, and solvents.

In February 1993 Gilbert Enterprises informed MDE that the bulk plant transfer station would be closed in June 1993.

MDE SAMPLING

Site and Brownfields Assessment/State Superfund Division

On December 17, 1996 personnel from MDE's Site and Brownfields Assessment/State Superfund Division collected thirteen soil samples, four surface water samples, and three sediment samples from the four parcels of property that comprise the Gilbert Tank Farm. Gilbert Enterprises owns

all four parcels. Two soil samples (S-2 and S-3) were collected from Parcel 472. A background soil sample (S-1) was collected from public property located east of Parcel 472 (Figure 3). Additionally, a surface water sample and a sediment sample (SW-3/SED-3) were collected just off shore north of Parcel 472. Background surface water and sediment samples (SW-1/SED-1) were collected upstream of the site

Samples were collected to determine the potential risk to human health and the environment relevant to the future use of the property. In addition to the samples collected from the four parcels of property that comprise the Gilbert Tank Farm, a duplicate solid and aqueous sample were collected, as well as spike samples for each matrix, to fulfill the EPA Contract Laboratory Program (CLP) protocol. All samples were analyzed for the Target Compound List (TCL) and Target Analyte List (TAL) analytes (Appendix B). One field blank (FB-1) was submitted to be analyzed to ensure the integrity of the sample collection procedures, the cleanliness of the sample containers, and the sample shipping procedures.

Soil boring samples were collected from the soil cuttings brought to the surface by hollow stemmed augers. All sample locations are indicated on Figure 3. Tables 1-8 summarize the contaminants detected in the samples. The laboratory analytical data from the samples collected at Parcel 472 are included as Volume II.

Oil Control Program

The site has been referred to the Oil Control Program in order to address the petroleum contamination issues.

TARGETS

Surface Water Potential Exposure Pathway

The site is adjacent to the Susquehanna River, which enters the Chesapeake Bay approximately one mile downstream from the site.

Ground Water Potential Exposure Pathway

There are no drinking water wells located within 1/4 mile of the site.

Soil Potential Exposure Pathway

Parcel 472 is fenced with a locked gate, minimizing access except from trespassers. The nearest residence is approximately 100 feet from the site across Water Street. The parcel is fairly well vegetated, with some areas of asphalt covering the soil.

There is a potential for soil exposure from incidental ingestion or airborne dust to on-site workers during construction or other intrusive activities.

Air Potential Exposure Pathway

The population around the site was not evaluated. The nearest residence was observed to be about 100 yards to the west of the site.

Because volatile organic compounds are not a concern at the site based on MDE's sampling, the air potential exposure pathway has not been identified as a concern.

MDE TOXICOLOGICAL EVALUATION

A toxicologist with MDE's Waste Management Administration evaluated the results from the MDE sampling event. Contaminant concentrations exceeding the Environmental Protection Agency (EPA) Region III Risk-Based Concentration (RBCs) were identified and evaluated. EPA Region III RBCs were developed to identify the level at which excess carcinogenic and noncarcinogenic risk would be present for residential and industrial scenarios. The complete toxicological evaluation is included in Appendix C.

Because the future land use at this site is unknown, both residential and commercial/industrial scenarios were evaluated. For the residential scenario, the adult resident, youth resident and child resident were evaluated. For the commercial/industrial scenario, the adult worker, youth trespasser and child trespasser were evaluated.

When determining whether an increased risk to human health or the environment exists at this site, it is important to understand that this evaluation contains many extremely conservative assumptions, a risk which exceeds EPA's recommended level of risk does not necessarily indicate an increased risk to human health. Therefore, although EPA's recommended level of risk is slightly exceeded for incidental ingestion of iron in soil for the child resident, exposure to iron is not expected to pose a risk to this population. EPA's recommended levels of risk are not exceeded for the adult resident, youth resident, adult worker, youth trespasser or child trespasser.

The surface water adjacent to the site was evaluated as if it were an untreated drinking water source. This indicates that EPA's recommended level of risk is slightly exceeded for thallium in drinking water for the adult resident, youth resident and child resident. However, because the Susquehanna River is not used as an untreated drinking water source at the site or downstream of the site, exposure is not expected to pose a threat.

While the evaluation of sediment contamination in the Susquehanna River for aquatic life was inconclusive, the surface water evaluation does not indicate increased risk to aquatic life.

RECOMMENDATIONS

Based on this information, there are no further requirements related to the investigation of hazardous waste at this site at this time. The Maryland Department of the Environment reserves its right to require additional investigation or cleanup if it determines the site poses a threat to public health or the environment or if any previously undiscovered, new or exacerbated levels of contamination are discovered.

FUTURE USE

The City of Havre de Grace is considering this property for a waterfront hotel conference center.

REFERENCES

1. MDE/Waste Management Administration, Oil Control Program records.

2. MDE/Water Management Administration, Water Supply Program. 1992.

3. USGS Topographic Map, Havre De Grace, 7.5 minute, 1953, photorevised 1979.

4. Harford County Records.

GILBERT TANK FARM - PARCEL 472
TABLE 1

Volatile Organic Compounds	Soil Samples (µg/mg)		
	S-1 (background)	S-2	S-3
Methylene Chloride	11B	9B	11B
Acetone	--	59B	12B

-- - not detected
B - present in the quality control sample
See Appendix B for list of analyzed compounds

GILBERT TANK FARM - PARCEL 472
TABLE 2

Volatile Organic Compounds	Surface Water/Sediment Samples (µg/l in surface water, µg/kg in sediment)			
	SW-1 (background)	SW-3	SED-1 (background)	SED-3
Methylene Chloride	--	--	2J	4B
Acetone	--	--	60B	74B

-- - not detected
B - present in the quality control sample
J - estimated concentration level
See Appendix B for list of analyzed compounds

GILBERT TANK FARM - PARCEL 472
TABLE 3

Semivolatile Organic Compounds	Soil Samples (µg/kg)		
	S-1 (background)	S-2	S-3
Phenanthrene	71J	--	--
Fluoranthene	200J	--	--
Pyrene	190J	--	58J
Benzo(a)anthracene	160J	--	--
Chrysene	170J	--	--
Bis(2-ethylhexyl)phthalate	320J	44J	230J
Benzo(b)fluoranthene	340NJ	--	--
Benzo(k)fluoranthene	270NJ	--	--
Benzo(a)pyrene	190J	--	--
Indeno(1,2,3-cd)pyrene	100J	--	--
Dibenz(a,h)anthracene	45J	--	--
Benzo(g,h,i)perylene	130J	--	--

-- - not detected
B - present in the quality control sample
NJ - presumed to be present at approximate concentration level
J - estimated concentration level
See Appendix B for list of analyzed compounds

GILBERT TANK FARM - PARCEL 472
TABLE 4

Semivolatile Organic Compounds	Surface Water/Sediment Samples (µg/l in surface water, µg/kg in sediment			
	SW-1 (background)	SW-3	SED-1 (background)	SED-3
Phenanthrene	--	--	--	100J
Fluoranthene	--	--	150J	330J
Pyrene	--	--	130J	250J
Benzo(a)anthracene	--	--	89J	180J
Chrysene	--	--	88J	170J
Bis(2-ethylhexyl)phthalate	--	1J	74J	180J
Benzo(b)fluoranthene	--	--	180NJ	280NJ
Benzo(k)fluoranthene	--	--	140NJ	230NJ
Benzo(a)pyrene	--	--	110J	160J
Indeno(c,d)pyrene	--	--	--	84J
Benzo(g,h,i)perylene	--	--	--	98J

-- - not detected
NJ - presumed to be present at approximate concentration levels
J - estimated concentration levels
See Appendix B for list of analyzed compounds

GILBERT TANK FARM - PARCEL 472
TABLE 5

Pesticides/PCBs	Soil Samples (µg/kg)		
	S-1 (background)	S-2	S-3
alpha-BHC	--	0.20B	--
delta-BHC	--	0.13J	0.27J
Dieldrin	0.085J	--	--
4,4'-DDE	4.6	--	0.10J
Endosulfan II	0.26J	--	--
4,4'-DDT	8.4	--	0.20J
Methoxychlor	32	2.1J	6.1J
Endrin ketone	0.13J	--	--
alpha-Chlordane	0.33J	--	--
gamma-Chlordane	0.23J	--	--

-- - not detected
B - present in the quality control sample
J - estimated concentration level
See Appendix B for list of analyzed compounds

GILBERT TANK FARM - PARCEL 472
TABLE 6

Pesticides/PCBs	Surface Water/Sediment Samples (µg/l in surface water, µg/kg in sediment)			
	SW-1 (background)	SW-3	SED-1 (background)	SED-3
gamma-BHC (Lindane)	.0082J	--	--	--
Heptachlor	0.0081J	--	--	0.26J
Aldrin	0.0092J	--	--	1.4J
Heptachlor epoxide	--	--	--	0.29J
Endosulfan I	--	--	--	0.29J
Dieldrin	0.020B	--	0.32J	1.6J
4,4'-DDE	--	--	1.2J	0.66J
Endrin	0.017J	--	0.53J	--
Endosulfan II	--	--	--	1.4J
4,4'-DDT	0.022B	--	1.3J	0.55J
Methoxychlor	--	--	--	22J
Endrin ketone	--	--	0.28J	--
Endrin aldehyde	--	--	0.56J	--
gamma-Chlordane	--	--	--	0.52J

-- - not detected
B - present in quality control sample
J - estimated concentration level
See Appendix B for list of analyzed compounds

GILBERT TANK FARM - PARCEL 472
TABLE 7

Inorganics	Soils (mg/kg)		
	S-1(background)	S-2	S-3
Aluminum	8870	8950	9620
Arsenic	4.0	5.1	4.0
Barium	161	48.6	33.8
Beryllium	0.65	0.88	0.44
Cadmium	0.64	1.2	0.50
Calcium	2730J	1600J	835J
Chromium	19.0	13.6	17.6
Cobalt	7.5	10.5	5.2
Copper	24.8	13.9	8.9
Cyanide	0.25B	0.13B	0.19B
Iron	15200	44100	16000
Lead	56.0	17.7	29.5
Magnesium	1850	1400	942
Manganese	348	455	168
Nickel	10.5	13.3	6.3
Potassium	638J	784J	777J
Silver	1.2	3.3	1.4
Sodium	105	109	63.1
Thallium	0.57	0.60	0.56
Vanadium	25.2	17.0	23.9
Zinc	75.1	43.6	40.6

B - present in quality control sample
J - estimated concentration level
See Appendix B for list of analytes

GILBERT TANK FARM - PARCEL 472
TABLE 8

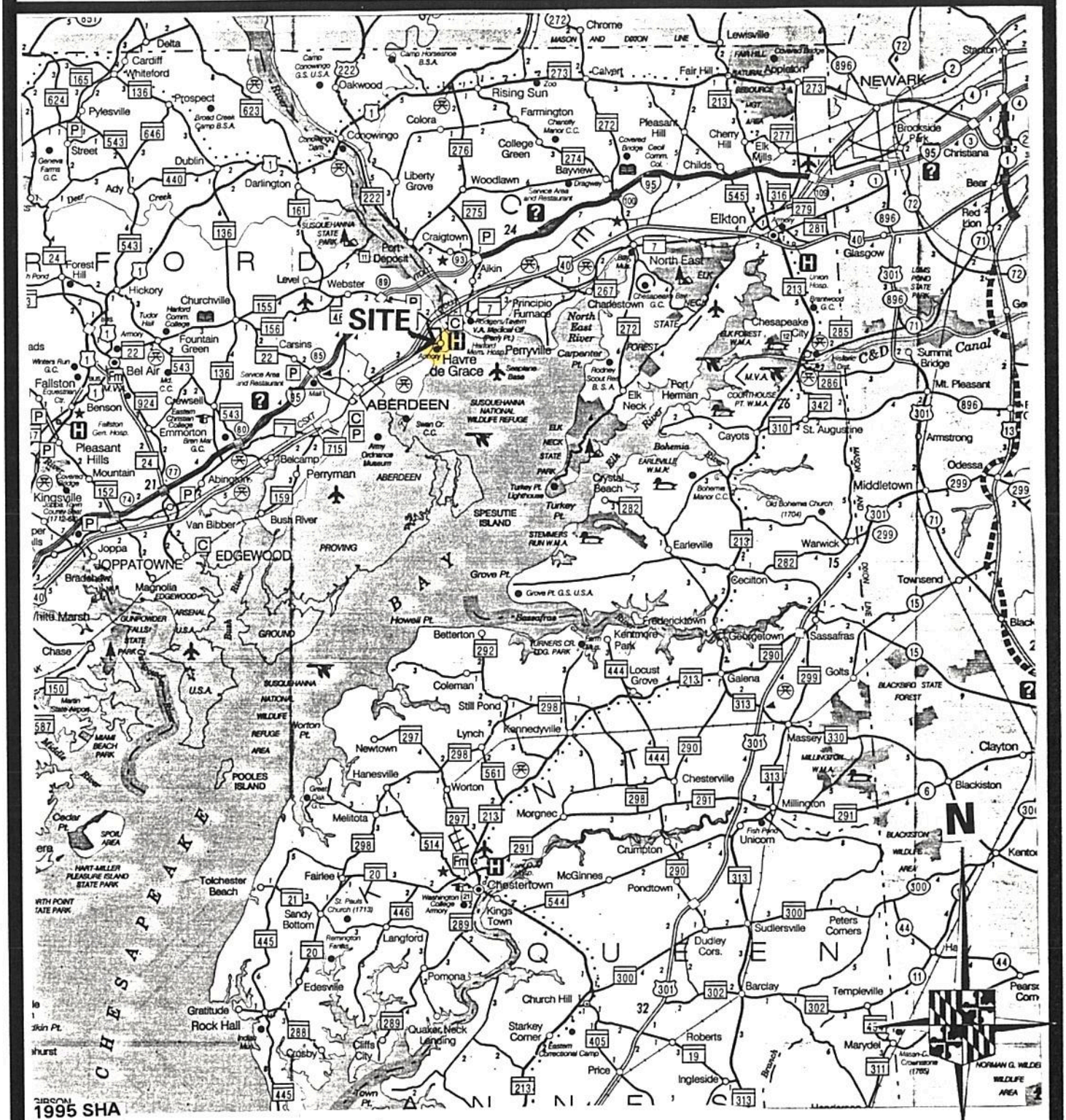
Inorganics	Surface Water and Sediment Samples (ug/l in surface water, mg/kg in sediment)			
	SW-1 (background)	SW-3	SED-1 (background)	SED-3
Aluminum	1430	1470	12100	14500
Arsenic	2.1	2.6K	2.6K	8.6K
Barium	37	37.1	107	142
Beryllium	0.60	0.60	1.1	2.1
Cadmium	1.1	1.1	0.64	1.8
Calcium	138J	14100J	1560J	3670J
Chromium	3.4B	3.1B	21.1	26.4
Cobalt	1.9	2.1	19.6	53.3
Copper	5.3B	3.2B	19.7	48.7
Cyanide	1.8B	1.5B	1.8	0.42B
Iron	1970L	2030L	22000	32600
Lead	3.6B	3.7B	19.3	61.1
Magnesium	4400	4640	3330	3890
Manganese	143	141	851	2050
Nickel	5.8	5.8	32.2	76.4
Potassium	2140J	2180J	1270J	1580J
Silver	1.4	1.4	1.8	3.4
Sodium	5270	5010	116	276
Thallium	2.5	5.6	1.0	1.4
Vanadium	2.4	2.1	23.6	24.8
Zinc	45.9B	48.2B	107	315

B - present in quality control sample
J - estimated concentration level
L - biased low. Actual concentration expected to be higher
K - biased high. Actual concentration expected to be lower
See Appendix B for list of analytes

APPENDIX A - FIGURES

REGIONAL HIGHWAY MAP

FIGURE 1



1995 SHA

SCALE

0 6 12 MILES

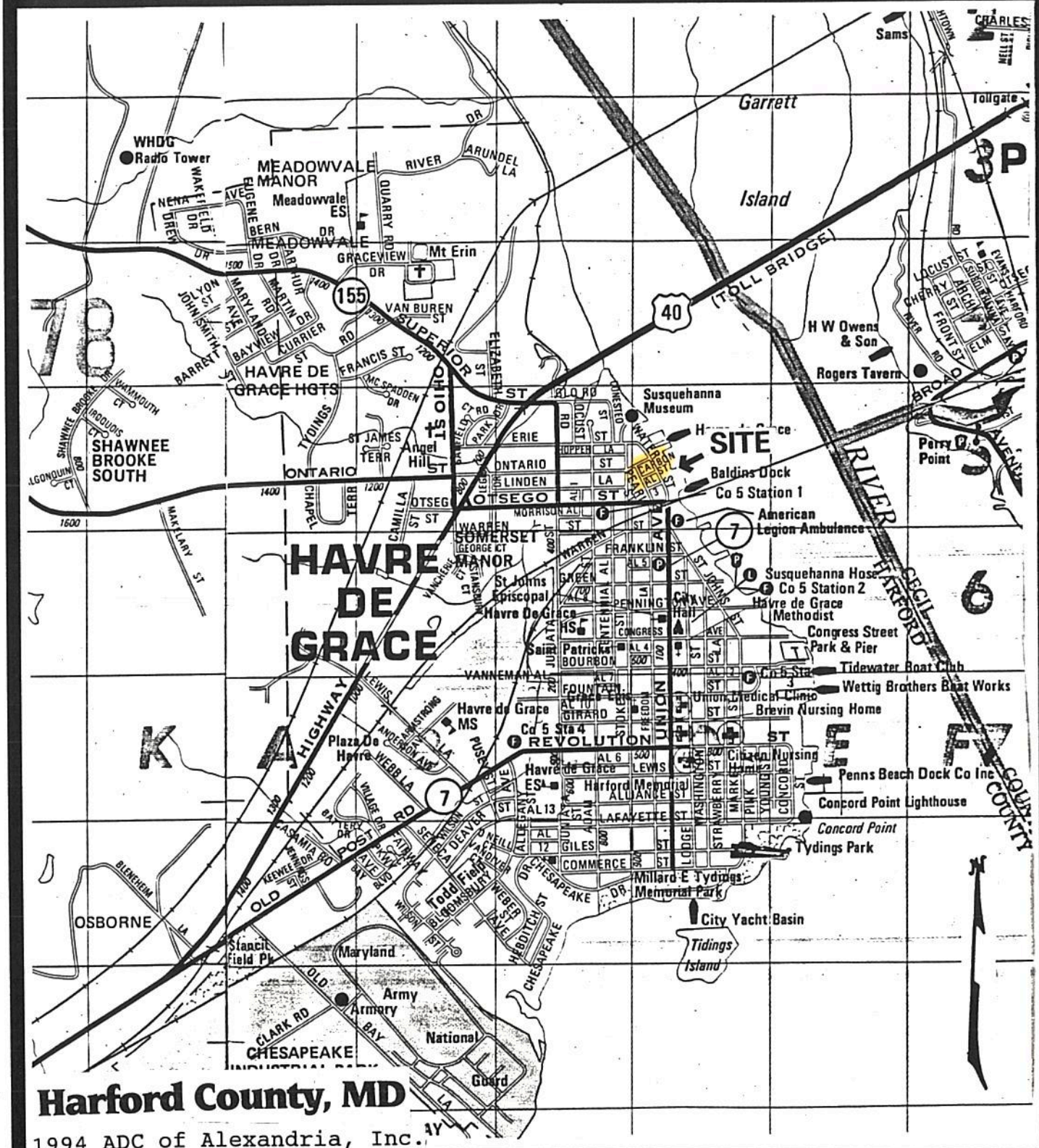
0 10 20 KILOMETERS

1:380,160

ORIGINAL
(Red)

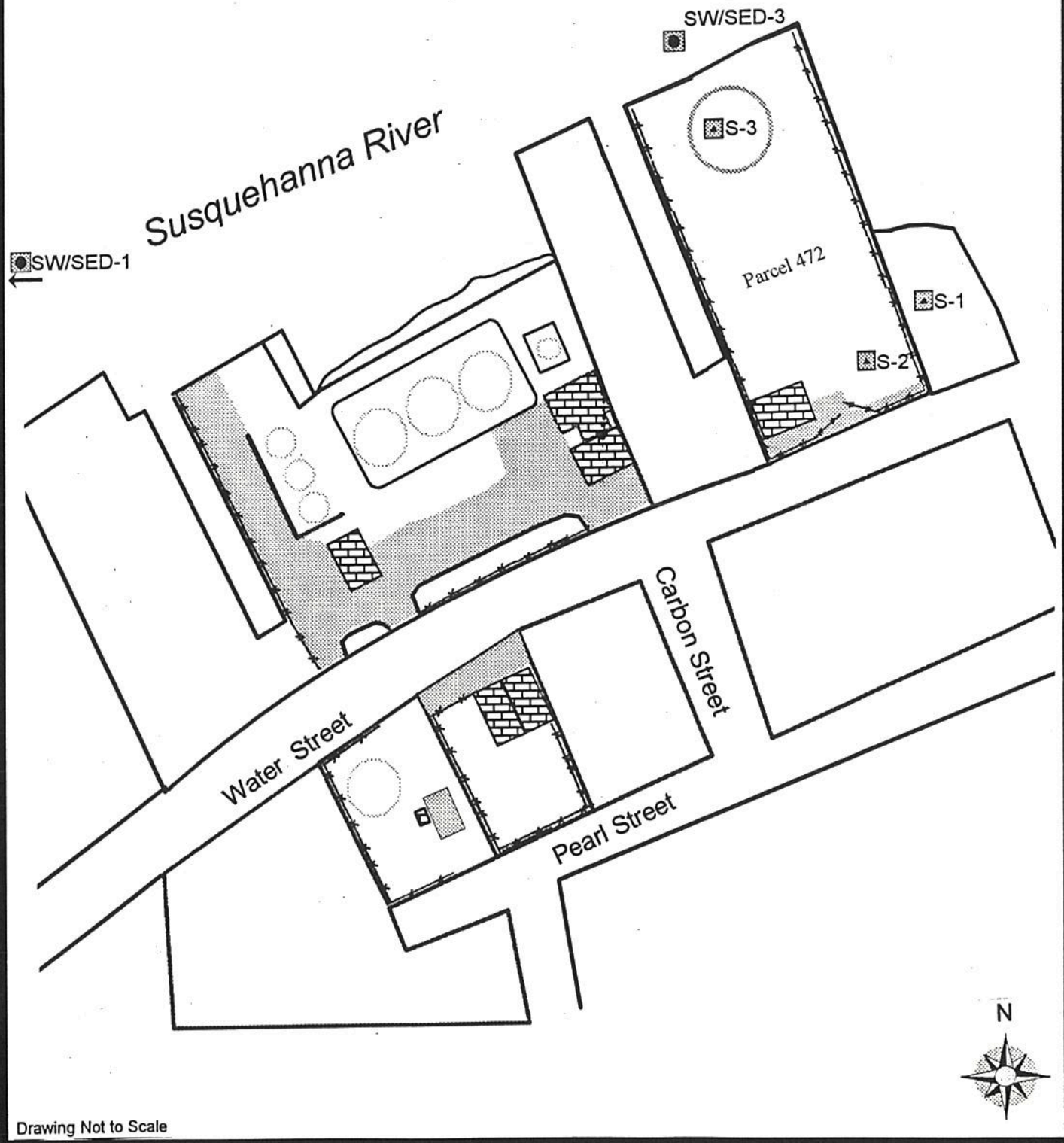
STREET MAP

FIGURE 2



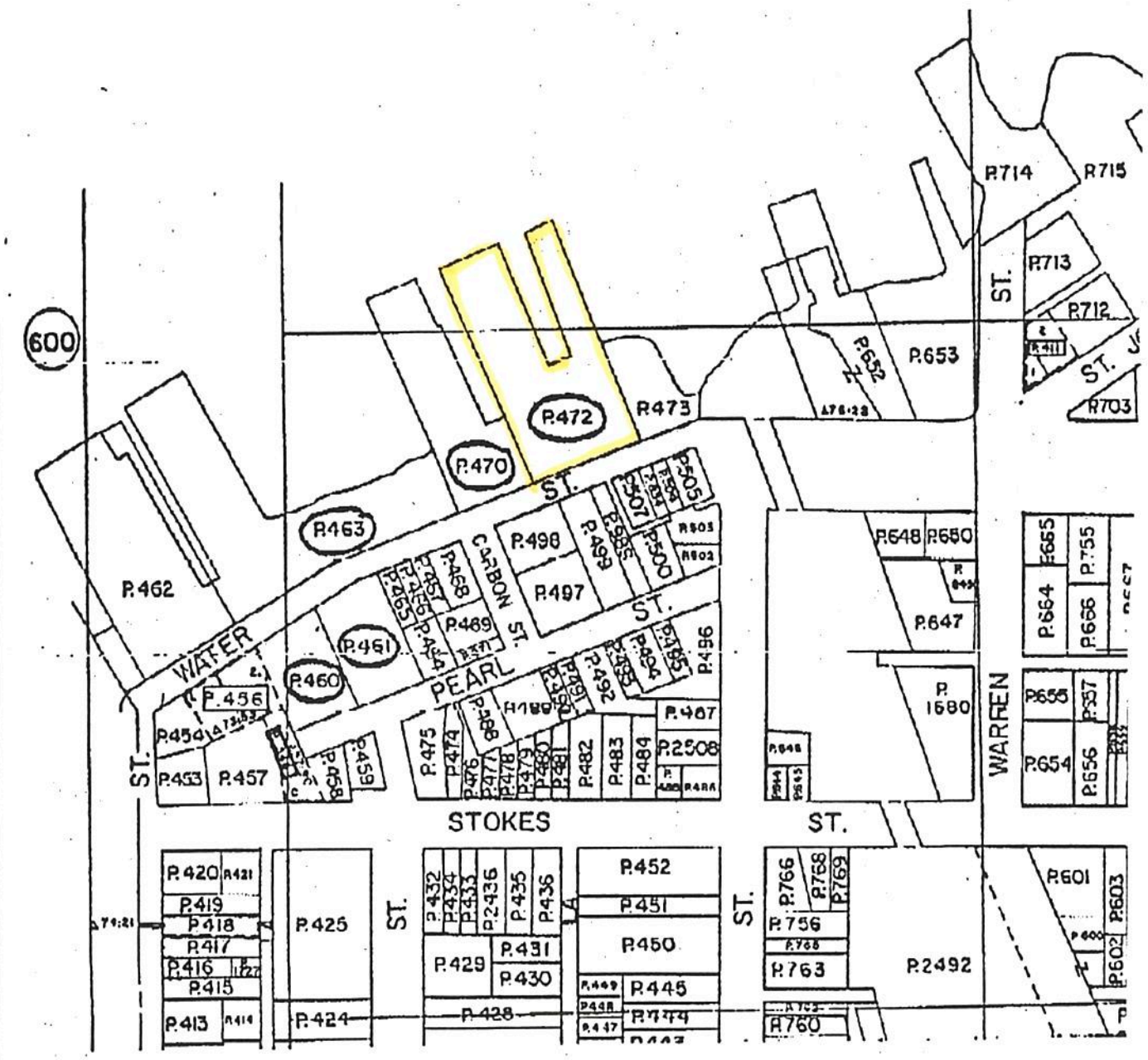
SITE MAP

Figure 3



PARCEL MAP

Figure 4



Not to Scale

APPENDIX B - TARGET ANALYTE LIST/TARGET COMPOUND LIST

TARGET COMPOUND LIST

VOLATILES

Acetone
Benzene
Bromodichloromethane
Bromoform
Bromomethane
2-Butanone
Carbon Disulfide
Carbon Tetrachloride
Chlorodibromomethane
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane
cis-1,2-Dichloropropene
trans-1,3-Dichloropropene
Ethylbenzene
2-Hexanone
Methylene Chloride
4-Methyl-2-Pentanone
Styrene
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Vinyl acetate
Vinyl chloride
Xylene (total)

SEMIVOLATILES

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)flouranthene
Benzoic Acid
Benzyl alcohol
Bis(2-chloroethyl)ether
Bis(2-chloroethoxy)methane
Bis(2-chloroisopropyl)ether
Bis(2-Ethylhexyl)phthalate
4-Bromophenyl phenyl ether
Butylbenzylphthalate
4-Chloroaniline
4-Chloro-3-methylphenol
2-Chloronaphthalene
2-Chlorophenol
4-Chlorophenyl phenyl ether
Chrysene
Dibenzo(a,h)anthracene
Dibenzofuran
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3-3'-Dichlorobenzidine
2,4-Dichlorophenol
Diethyl phthalate
2,4-Dimethylphenol
Di-n-butylphthalate
4,6-Dinitro-2-methylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Dimethylphthalate
Di-n-octylphthalate
Fluoranthene
Fluorene
Hexachlorobenzene

Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachlorethane
Indeno(1,2,3-cd)pyrene
Isophorone
2-Methylnaphthalene
2-Methylphenol
4-Methylphenol
Naphthalene
2-Nitroaniline
3-Nitroaniline
4-Nitroaniline
Nitrobenzene
2-Nitrophenol
4-Nitrophenol
N-Nitrosodiphenylamine
N-Nitroso-di-n-propylamine
Pentachlorophenol
Phenanthrene
Phenol
Pyrene
1,2,4-Trichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol

PESTICIDES AND PCBS

Aldrin
alpha-BHC
beta-BHC
gamma-BHC (Lindane)
delta-BHC
alpha-Chlordane
gamma-Chlordane
4,4-DDT
4,4-DDE
4,4-DDD
Dieldrin
Endosulfan
Endosulfan II
Endosulfan sulfate
Endrin
Endrin ketone
Heptachlor
Heptachlor epoxide
Methoxychlor
PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260
Toxaphene

TARGET ANALYTE LIST

(INORGANICS)

Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Cyanide
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Thallium
Sodium
Vanadium
Zinc

APPENDIX C - TOXICOLOGICAL EVALUATION

10/14/97

Gilbert Tank Farm/Parcel 472

Toxicological Evaluation

Summary

Risk at the Gilbert Tank Farm/Parcel 472 site was evaluated for child (1 - 6 years), youth (6 - 17 years), and adult residents under residential scenarios, for adult workers under commercial/industrial scenarios, and for youth (6 - 17 years) and child (1 - 6 years) trespassers under trespassing scenarios. USEPA recommended default exposure parameters were used to estimate cumulative risk from all chemicals in each scenario (1, 2, 3). The United States Environmental Protection Agency (USEPA) recognizes as an acceptable Hazard Index (HI) values less than or equal to 1 and excess lifetime cancer risk (CR) less than or equal to 10^{-4} - 10^{-6}. Based on these exposures, estimated risks at the site were compared to USEPA recommended levels, and the following conclusions were reached:

USEPA's recommended noncarcinogenic risk for the adult, youth (6 - 17 years), and the child (1 - 6 years) resident are slightly exceeded (HI > 1) through ingestion of surface water.
For the 3 residential populations, thallium is the risk driver.

USEPA's recommended noncarcinogenic risk for the child (1 - 6 years) resident is slightly exceeded (HI > 1) through incidental ingestion of soil.
Iron is the risk driver.

Although USEPA recommended levels of risk are exceeded for these populations, exposure to contaminants at this site is not expected to pose a threat to public health for either residential or commercial/industrial populations.

While the evaluation of sediment contaminant levels for risk to aquatic life was inconclusive, the surface water evaluation does not indicate increased risk to aquatic life.

1.0 Site Description

The Gilbert Tank Farm site is located in Havre de Grace, Maryland. For this Brownfields investigation, the site was divided into 4 parcels, identified as Parcels 460, 461, 463, and 472. This toxicological evaluation is for Parcel 472, which is a lot approximately 1.33 acres adjacent to the Susquehanna River. The property is fenced, although the fence may not be a permanent restriction. This area of the Susquehanna River is designated Use I-P in the Code of Maryland

Regulations (COMAR) and is protected for public water supply, water contact recreation, and aquatic life (4). Public water supply intakes are located upstream of the site. Two soil samples were collected at Parcel 472. These samples were collected at depths of 5 feet. Following the direction of the project manager, contaminant concentrations in the surface soil is assumed to be consistent with those detected throughout the soil. Therefore, this evaluation will assume all populations will be exposed to contaminants at concentrations similar to those detected in the samples collected.

One surface water sample was collected coincident with a sediment sample from the Susquehanna River, just offshore of the site. Background samples were collected for soil, surface water, and sediment.

2.0 Method

In evaluating risk to human health and the environment, maximum concentrations of all chemicals detected in soil, surface water, and sediment were compared to medium-specific screening levels. Chemicals which exceeded human health screening levels were then evaluated quantitatively. Any chemical which exceeded an ecological screening level and was present at a concentration above background was then evaluated more comprehensively.

2.1 Human Health

Maximum detected concentrations of all chemicals detected in soils (dry weight values) were compared to the USEPA Region III Risk Based Concentrations (RBC) for residential soils (5). Comparison of dry weight analytical values to the RBCs is recognized as a conservative measure but provides consistency in risk assessments across sites (with variable soil moisture content) and sampling time. Prior to comparison with each chemical concentration, noncarcinogenic RBCs were multiplied by 0.1, in order to account for any additivity of systemic effects. Any contaminant which exceeded its respective RBC was then evaluated quantitatively. This quantitative evaluation is based on expected future use and development scenarios and includes populations typically expected to frequent the site based on this proposed future use.

At this location, the Susquehanna River is designated as a potable water supply, and surface water is assumed to be utilized as a public water source. The maximum detected contaminant concentrations in surface water samples collected from the Susquehanna River were compared to Maryland's water quality standards for the protection of human health through drinking water (4) or, for those substances for which Maryland has not yet developed standards, USEPA's recommended ambient water quality criteria (AWQC) for human health through drinking water (6). Additionally, the maximum concentration of each chemical identified in the surface water was compared to RBC levels for tap water (5). Contaminants detected in surface water which exceeded their respective RBCs were included in the quantitative evaluation.

As no sediment RBCs have been developed, maximum detected concentrations for each contaminant identified in sediment samples were compared to residential RBCs for soil (5). These levels are a conservative screen since frequent exposure to sediment is much less likely than for soils. Any contaminant which exceeded its respective RBC was then evaluated quantitatively.

The future land use at the Gilbert Tank Farm site is unknown. Therefore, both residential and commercial/industrial scenarios were used to evaluate risk at Parcel 472. The Susquehanna River is a source of water for the Havre de Grace municipal water supply. The contaminants identified at the site at concentrations which exceeded RBCs were evaluated with regard to risk to relevant populations under the following scenarios (1, 2, 3):

Residential Development:

Adult Resident: 70 kg body weight, 350 days per year exposure for soil and surface water ingestion, 100 mg soil ingested per day, 2 liters of surface water ingested per day, 52 days per year exposure for sediment ingestion (2 days per week for 26 weeks), 50 mg sediment ingested per day, 30 year exposure duration, 70 year lifetime.

Youth Resident (6 - 17 years): 40 kg body weight, 350 days per year exposure for soil and surface water ingestion, 100 mg soil ingested per day, 2 liters of surface water ingested per day, 78 days per year exposure for sediment ingestion (3 days per week for 26 weeks), 50 mg sediment ingested per day, 12 year exposure duration, 70 year lifetime.

Child Resident (1 - 6 years): 16 kg body weight, 350 days per year exposure for soil and surface water ingestion, 200 mg soil ingested per day, 1 liter of surface water ingested per day, 78 days per year exposure for sediment ingestion (3 days per week for 26 weeks), 100 mg sediment ingested per day, 6 year exposure duration, 70 year lifetime.

Commercial/Industrial Development:

Adult Worker: 70 kg body weight, 250 days per year exposure for soil and surface water ingestion, 50 mg soil ingested per day, 1 liter of surface water ingested per day, 52 days per year exposure for sediment ingestion (2 days per week for 26 weeks), 50 mg sediment ingested per day, 25 year exposure duration, 70 year lifetime.

Youth Trespasser (6 - 17 years): 40 kg body weight, 132 days per year exposure for soil ingesion (5 days per week during 12 summer weeks and 3 days per week during 24 spring and fall weeks), 100 mg soil ingested per day, 78 days per year exposure for sediment ingestion (3 days per week for 26 weeks), 50 mg sediment ingested per day, 12 year exposure duration, 70 year lifetime.

Child Trespasser (1 - 6 years): 16 kg body weight, 132 days per year exposure for soil ingestion (5 days per week during 12 summer weeks and 3 days per week during 24 spring and fall weeks), 200 mg soil ingested per day, 78 days per year exposure for sediment ingestion (3 days per week for 26 weeks), 100 mg sediment ingested per day, 6 year exposure duration, 70 year lifetime.

The youth trespasser and the child trespasser are not assumed to ingest surface water while trespassing on the site, although incidental ingestion of surface water during recreational activities might occur. Exposure during recreational activities includes both incidental ingestion of surface water and sediment, and the estimation of risk through incidental ingestion of sediment during recreational activities contributes to the cumulative risk more significantly. Therefore, the risk from incidental ingestion of surface water is negligible by comparison, and is not quantitatively estimated in this assessment.

2.2 Ecological

In the evaluation of potential ecological risk, future use of the site was considered. Since the future use is not known, these plans include residential or commercial/industrial development, and both people and wildlife are likely to be exposed. The risk through exposure to soil assessed for human health may be considered protective of any wildlife which may frequent the site.

Maximum contaminant concentrations detected in the surface water samples were compared to Maryland's water quality standards for the protection of aquatic life from acute and chronic effects (4). For those substances for which Maryland has no numeric water quality standards, USEPA's recommended ambient aquatic life criteria were utilized (6).

Sediment screening levels for ecological risk are less readily available than surface water screening levels. Therefore, the maximum detected concentration in sediments was first compared to the background sample to determine if the samples adjacent to the site exceeded background levels, then the site concentration was compared to USEPA's draft sediment quality criteria (which assume 1% organic carbon) (7). For those substances for which USEPA has not drafted sediment quality criteria (SQC), sediment quality benchmarks (SQB), developed in a manner consistent with that of the draft sediment quality criteria and assuming 1% organic carbon content of sediments, were utilized (7). Sediment quality benchmarks were derived for screening for those chemicals for which EPA has not published SQBs. For substances for which neither of these screening values are available, the Effects Range-Median (ER-M) values developed by the National Oceanic and Atmospheric Administration (NOAA) were used (8). These values represent sediment concentrations which, in half the sediment samples evaluated, were associated with sediment toxicity.

3.0 Human Health Evaluation

3.1 Soil

The chemicals detected in site soils which exceeded RBCs are aluminum, arsenic, beryllium, iron, and manganese. These contaminants are included in the quantitative evaluation.

No RBC is available for lead. USEPA has issued a directive which recommends a screening level of 400 ppm for residential scenarios at RCRA facilities and CERCLA sites, which is used in this evaluation (9). The maximum concentration of lead detected in soils at Parcel 472 does not exceed this screening value.

Magnesium, calcium, potassium, and sodium are essential nutrients toxic only at very high concentrations and are found naturally in soils. No RBC levels exist for these chemicals, and they are not included in the quantitative risk estimate.

The background soil sample was found to contain several chemicals at concentrations in excess of RBC levels (5). These chemicals are aluminum, arsenic, beryllium, iron, manganese, and several PAHs, including benzo[a]pyrene. Risk through exposure to chemicals found in the background soil sample was also evaluated.

The quantitative estimate of risk through incidental soil ingestion included arsenic and beryllium evaluated for carcinogenic and noncarcinogenic risks (Tables 1, 2, 7, and 8) (5). Aluminum, iron, and manganese were evaluated only for noncarcinogenic risks (Tables 1 and 7); they are not considered carcinogens (5). Reference dose (RfD) and cancer potency (q_1*) values were obtained from USEPA Region III and IRIS (5, 10).

3.2 Surface Water

No contaminants identified in the surface water exceeded Maryland water quality standards (4). Thallium was identified at SW-3 at a concentration of 5.6 ug/l, which exceeds the USEPA recommended ambient water quality criterion of 1.7 ug/l for the protection of human health through water and organisms (6) but does not exceed the USEPA criterion of 6.0 ug/l for the protection of human health through organisms (6). Contaminants identified in surface water which exceeded RBC screening values are arsenic, iron, manganese, and thallium (5).

The background surface water sample was found to contain chemicals in excess of RBC levels (5). These chemicals are iron and manganese. Risk through exposure to chemicals found in the background surface water sample was also evaluated.

Evaluation of risk from exposure to contaminants in surface water included arsenic for carcinogenic and noncarcinogenic risks (Tables 3, 4, 9, and 10). Iron, manganese, and thallium were evaluated for noncarcinogenic risks only (Tables 3 and 9) (5). Reference dose (RfD) and

cancer potency (q_1*) values were obtained from USEPA Region III and IRIS (5, 10).

3.3 Sediment

Chemicals identified in the sediment which exceeded RBC screening values are aluminum, arsenic, beryllium, iron, manganese, and several PAHs, including benzo[a]pyrene, and they are included in the quantitative assessment (5).

Not all PAHs were detected at concentrations which exceeded RBCs. There are over 100 PAHs, but benzo[a]pyrene is by far the most researched because of the early recognition of its carcinogenicity. Therefore, since benzo[a]pyrene exceeds its RBC (5), maximum concentrations of all detected PAHs, including those for which no RBCs are available (benzo[g,h,i]perylene and phenanthrene) are included in the quantitative assessment.

The background sediment sample was found to contain several chemicals in excess of RBC levels (5). These chemicals are aluminum, arsenic, beryllium, iron, manganese, and several PAHs. Risk through exposure to chemicals found in the background sediment sample was also evaluated.

Of the contaminants identified in sediment, aluminum, iron, and manganese were evaluated for noncarcinogenic risks (Tables 4 and 9) (5). Arsenic and beryllium were evaluated for both noncarcinogenic and carcinogenic risks (Tables 5, 6, 11, and 12) (5). Reference dose (RfD) and cancer potency (q_1*) values were obtained from USEPA Region III and IRIS (5, 10)

PAHs are a group of chemically similar compounds that are found naturally or as a result of human activity. Noncarcinogenic risk was evaluated for all PAHs detected at the site for which RfDs are available or which are structurally similar to those for which RfDs are available (Tables 1 and 6). RfDs are not available for the four PAHs detected at the site for which no RBCs are available. These chemicals were then compared on a structural basis, in order to identify an appropriate RfD value for the quantitative assessment. For phenanthrene and benzo[g,h,i]perylene, pyrene was used (11, 12).

Many PAHs have been shown to exhibit carcinogenic potential in studies with laboratory animals following oral absorption. Of these, the most studied is benzo[a]pyrene, which is considered a group B2 (probable human) carcinogen and for which specific toxicity information, including a cancer slope factor, q_1*, exists (11, 13). PAHs considered to be carcinogenic and for which USEPA has not yet derived q_1* values, were evaluated using their relative potency values (relative to benzo[a]pyrene) to adjust their maximum concentrations to "relative" concentrations (13), as shown in Table 18. Presently, there are no regulatory levels to assess the systemic risk associated with exposure to carcinogenic PAHs; noncarcinogenic risk is not evaluated for these PAHs. Human health risk due to exposure to these PAHs is therefore assessed based on potential carcinogenicity, and is presented in Tables 6 and 12.

4.0 Ecological Evaluation

4.1 Surface Water

Surface water contaminants were compared to Maryland ambient water quality standards and federal water quality criteria. No contaminants were found to exceed Maryland's standards (4). Aluminum and iron were detected at maximum concentrations of 1470 ug/l and 2030 ug/l, respectively, which are similar to background concentrations of 1430 ug/l for aluminum and 1970 ug/l for iron. These concentrations exceed USEPA chronic water quality criteria for the protection of freshwater aquatic life, 87 ug/l for aluminum and 1000 ug/l for iron, which, as with Maryland's standards, are based on dissolved metals while the site data reflect total metals (6). Additionally, the freshwater iron criterion is based on a 1976 qualitative study, and Maryland finds this criterion technically insufficient. Maryland standards or USEPA criteria are not available for barium, cobalt, and manganese; however, these chemicals were detected at concentrations similar to background levels. No standards or criteria are available for calcium, magnesium, potassium, and sodium, which are natural constituents of water.

4.2 Sediment

In the evaluation of contaminants identified in sediment, nickel was detected at 76.4 mg/kg, which slightly exceeds the NOAA ER-M value of 51.6 mg/kg. Additionally, nickel is present in the site sediments at concentrations which exceed background levels of 32.2 mg/kg (8). It is important to note that NOAA ER-M values were derived using marine and estuarine sediments, which may differ from freshwater sediments in bioavailability of metals and sensitivity of resident organisms. Additionally, the ER-M value for nickel is considered to be technically insufficient by the author (8). Calcium, sodium, potassium, and magnesium, which are natural constituents of sediment, do not have screening criteria and are unlikely to pose significant ecological risk. No screening values are available for aluminum, barium, beryllium, cobalt, copper, iron, manganese, vanadium, bis(2-ethylhexyl)phthalate, and aldrin, and all except manganese were present at concentrations which exceeded background levels.

5.0 Conclusion

5.1 Human Health

The estimated risk for the adult and youth (6 - 17) resident (Table 1) and the adult worker, youth trespasser, and child trespasser (Table 7) from incidental ingestion of soil falls at or below the noncarcinogenic risk recommended by USEPA, while the estimated risk for the child resident from incidental ingestion of surface soil exceeds this value (Table 1). A closer evaluation of the estimated risk to the child resident shows that iron is a risk driver; that is, exposure to iron exceeds the USEPA's recommended levels of risk. All populations considered to be exposed through incidental ingestion of soil fall within the acceptable CR (Tables 2 and 8).

Risk estimated from ingestion of surface water resulted in HI values for all 3 residential populations (Table 3) exceeding the level recommended by USEPA. For all populations, thallium is the risk driver. The adult worker population (Table 9) falls within USEPA's recommended level. No CR values exceeded USEPA's recommended levels of risk (Tables 4 and 10).

The calculated noncarcinogenic and carcinogenic risks from incidental exposure to sediment fall within or below USEPA recommended levels (Tables 5, 6, 11, and 12).

In summary, the noncarcinogenic risk estimated for child (1 - 6) residents exceeds USEPA recommended levels. Iron in soil has been identified as a risk driver (Table 21). The noncarcingenic risk from surface water for all 3 residential populations exceeds USEPA acceptable levels of risk. Thallium is the risk driver for all 3 populations (Table 21).

When determining whether an increased risk to human health exists at this site, it is important to understand that this evaluation was prepared as a first level screening evaluation. Many conservative assumptions are included in this evaluation, which was developed with the understanding that if the estimated risk, with the conservative assumptions, does not exceed USEPA's recommended levels, then the risk estimated using more realistic scenarios will not exceed these levels.

However, because this evaluation includes many conservative assumptions, a risk which exceeds USEPA's recommended level of risk does not necessarily indicate an increased risk to human health. When this situation occurs, it is necessary to consider several points when determining if the risk actually does represent a threat to human health. For example, the quantitative risk estimate in this evaluation assumes people will be exposed to a contaminant at the maximum concentration all throughout the site and for the entire exposure duration, which does not take into account whether the maximum concentration is anomalous or characteristic of the site, or biodegradation, dispersion, dilution, or other factors which may decrease the contaminant concentration throughout the time of exposure.

This evaluation also assumes that the bioavailability of each contaminant is 100%, and that all of the contaminant taken into the body is absorbed across the digestive tract into the body. A chemical is harmful to human health only if it is absorbed into the body. Assuming complete bioavailability does not consider the fact that it is common for a fraction of the chemical taken into the body is excreted rather than being absorbed into the body. The bioavailability of a contaminant is dependent on many factors, such as the state or form of the contaminant and if the actual size of the contaminant particle would permit incidental ingestion. These issues must be considered when evaluating the appropriateness of assuming total bioavailability of a contaminant.

Another point to consider when evaluating risk is the media. Estimated risk from exposure to surface water at this site exceeded USEPA's recommended level, and this risk can be attributed

to thallium. Surface water data used in this evaluation conservatively reflect total metals. Water treatment processes would typically include some type of sediment coagulation or settling process. People drinking this water would not be drinking it directly from the Susquehanna River, but rather after it was treated at a water treatment plant. Therefore, the risk calculated for this pathway overestimates the actual risk from exposure to surface water.

Finally, conservatism is inherent in the risk estimates. The USEPA recommended level of noncarcinogenic risk is less than or equal to 1. This level of risk represents a "no effect" level (calculated to incorporate appropriate safety factors), which is a dose at which no adverse health effects are expected. Exceeding this "no effect" level does not indicate a risk, only that the potential for a risk may exist. This potential increases as the hazard index exceeds 1, which means that the potential for risk is greater when a hazard index is at 10 than when it is at 3. When assessing carcinogenic risk, the USEPA recommended range of risk is 10^{-4} to 10^{-6}. This range represents the upper confidence limit, whereas the lower bound estimate of excess lifetime cancer risk is zero.

At Parcel 472, the estimated risk for the child (1 - 6 years) resident exposed through incidental ingestion of soil is 2, which exceeds USEPA's recommended level, and iron is the risk driver. Additionally, the risk to all three residential populations exposed through ingestion of surface water was estimated to exceed the recommended levels, with thallium as the risk driver for all three populations. Although these estimated risks exceed USEPA's recommended level, considering the factors mentioned above, it is not expected that exposure to contaminants through these pathways would pose an increased risk to residential or commercial/industrial populations.

5.2 Ecological

An ecological assessment of the site shows that nickel is present in sediment above background levels at concentrations which slightly exceed NOAA ER-M values and background concentrations. Additionally, aluminum, barium, beryllium, cobalt, iron, manganese, vanadium, bis(2-ethylhexyl)phthalate, and aldrin were all detected in the site sediment at concentrations above background. The evaluation of surface water at the site does not indicate increased risk to aquatic life.

6.0 References

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Gilbert Tank Farm - Parcel 472

Table 1. Quantitative Risk Assessment - Noncarcinogenic

Residential Use - Incidental Ingestion/Soil

Chemical	RfD	Soil [ ] Max (mg/kg)	ADD Adult Resident	HQ	ADD Youth Resident (6 - 17 years)	HQ	ADD Child Resident (1 - 6 years)	HQ
Aluminum	1	9620	1E-02	1E-02	2E-02	2E-02	1E-01	1E-01
Arsenic	0.0003	5.1	7E-06	2E-02	1E-05	4E-02	6E-05	2E-01
Beryllium	0.005	0.88	1E-06	2E-04	2E-06	4E-04	1E-05	2E-03
Iron	0.3	44100	6E-02	2E-01	1E-01	4E-01	5E-01	2E+00
Manganese	0.14	455	6E-04	4E-03	1E-03	8E-03	5E-03	4E-02
			SUM-->	0.2	**SUM-->**	0.4	**SUM-->**	2

ADD = Average Daily Dose
HQ = Hazard Quotient

Table 2. Quantitative Risk Assessment - Carcinogenic

Residential Use - Incidental Ingestion/Soil

Chemical	q1*	Soil [ ] Max (mg/kg)	LADD Adult Resident	CR	LADD Youth Resident (6 - 17 years)	CR	LADD Child Resident (1 - 6 years)	CR
Arsenic	1.5	5.1	3E-06	4E-06	2E-06	3E-06	5E-06	8E-06
Beryllium	4.3	0.88	5E-07	2E-06	4E-07	2E-06	9E-07	4E-06
			SUM-->	7E-06	**SUM-->**	5E-06	**SUM-->**	1E-05

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Gilbert Tank Farm - Parcel 472

Table 3. Quantitative Risk Assessment - Noncarcinogenic

Residential Use - Ingestion/Surface Water

Chemical	RfD	Surface Water [ ] Max (mg/l)	ADD Adult Resident	HQ	ADD Youth Resident (6 - 17 years)	HQ	ADD Child Resident (1 - 6 years)	HQ
Arsenic	3E-04	0.0026	7E-05	2E-01	6E-05	2E-01	2E-04	5E-01
Iron	0.3	2.03	6E-02	2E-01	5E-02	2E-01	1E-01	4E-01
Manganese	0.14	0.141	4E-03	3E-02	3E-03	2E-02	8E-03	6E-02
Thallium	8E-05	0.0056	2E-04	2E+00	1E-04	2E+00	3E-04	4E+00
			SUM-->	2	**SUM-->**	2	**SUM-->**	4

ADD = Average Daily Dose
HQ = Hazard Quotient

Table 4. Quantitative Risk Assessment - Carcinogenic

Residential Use - Ingestion/Surface Water

Chemical	q1*	Surface Water [ ] Max (mg/l)	LADD Adult Resident	CR	LADD Youth Resident (6 - 17 years)	CR	LADD Child Resident (1 - 6 years)	CR
Arsenic	1.5	0.0026	3E-05	5E-05	1E-05	2E-05	1E-05	2E-05
			SUM-->	5E-05	**SUM-->**	2E-05	**SUM-->**	2E-05

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Gilbert Tank Farm - Parcel 472

Table 5. Quantitative Risk Assessment - Noncarcinogenic

Residential Use - Incidental Ingestion/Sediment

Chemical	RfD	Sediment [ ] Max (mg/kg)	ADD Adult Resident	HQ	ADD Youth Resident (6 - 17 years)	HQ	ADD Child Resident (1 - 6 years)	HQ
Aluminum	1	14500	1E-03	1E-03	4E-03	4E-03	2E-02	2E-02
Arsenic	0.0003	8.6	9E-07	3E-03	2E-06	8E-03	1E-05	4E-02
Beryllium	0.005	2.1	2E-07	4E-05	6E-07	1E-04	3E-06	6E-04
Iron	0.3	32600	3E-03	1E-02	9E-03	3E-02	4E-02	1E-01
Manganese	0.14	2050	2E-04	1E-03	5E-04	4E-03	3E-03	2E-02
Benzo[g,h,i]perylene*	0.03	0.098	1E-08	3E-07	3E-08	9E-07	1E-07	4E-06
Fluoranthene	0.04	0.33	3E-08	8E-07	9E-08	2E-06	4E-07	1E-05
Phenanthrene*	0.03	0.1	1E-08	3E-07	3E-08	9E-07	1E-07	4E-06
Pyrene	0.03	0.25	3E-08	8E-07	7E-08	2E-06	3E-07	1E-05
			SUM-->	0.02	**SUM-->**	0.04	**SUM-->**	0.2

ADD = Average Daily Dose
HQ = Hazard Quotient
* = Toxicity Data for Pyrene, a Structurally Similar Analogue, Were Used

Table 6. Quantitative Risk Assessment - Carcinogenic

Residential Use - Incidental Ingestion/Sediment

Chemical	q1*	Sediment [ ] Max (mg/kg)	LADD Adult Resident	CR	LADD Youth Resident (6 - 17 years)	CR	LADD Child Resident (1 - 6 years)	CR
Arsenic	1.5	8.6	4E-07	6E-07	4E-07	6E-07	1E-06	1E-06
Beryllium	4.3	2.1	9E-08	4E-07	1E-07	4E-07	2E-07	1E-06
PAHs	7.3	0.22	1E-08	7E-08	1E-08	7E-08	3E-08	2E-07
			SUM-->	1E-06	**SUM-->**	1E-06	**SUM-->**	3E-06

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Gilbert Tank Farm - Parcel 472

Table 7. Quantitative Risk Assessment - Noncarcinogenic

Commercial/Industrial Use - Incidental Ingestion/Soil

Chemical	RfD	Soil [ ] Max (mg/kg)	ADD Adult Worker	HQ	ADD Youth Trespasser (6 - 17 years)	HQ	ADD Child Trespasser (1 - 6 years)	HQ
Aluminum	1	9620	5E-03	5E-03	9E-03	9E-03	4E-02	4E-02
Arsenic	0.0003	5.1	2E-06	8E-03	5E-06	2E-02	2E-05	8E-02
Beryllium	0.005	0.88	4E-07	9E-05	8E-07	2E-04	4E-06	8E-04
Iron	0.3	44100	2E-02	7E-02	4E-02	1E-01	2E-01	7E-01
Manganese	0.14	455	2E-04	2E-03	4E-04	3E-03	2E-03	1E-02
			SUM-->	0.09	**SUM-->**	0.2	**SUM-->**	0.8

ADD = Average Daily Dose
HQ = Hazard Quotient

Table 8. Quantitative Risk Assessment - Carcinogenic

Commercial/Industrial Use - Incidental Ingestion/Soil

Chemical	q1*	Soil [ ] Max (mg/kg)	LADD Adult Worker	CR	LADD Youth Trespasser (6 - 17 years)	CR	LADD Child Trespasser (1 - 6 years)	CR
Arsenic	1.5	5.1	2E-06	4E-06	5E-06	7E-06	2E-06	3E-06
Beryllium	4.3	0.88	4E-07	2E-06	8E-07	3E-06	3E-07	1E-06
			SUM-->	6E-06	**SUM-->**	1E-05	**SUM-->**	4E-06

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Gilbert Tank Farm - Parcel 472

Table 9. Quantitative Risk Assessment - Noncarcinogenic

Commercial/Industrial Use - Ingestion/Surface Water

Chemical	RfD	Surface Water [ ] Max (mg/l)	ADD Adult Worker	HQ	ADD Youth Trespasser (6 - 17 years)	HQ	ADD Child Trespasser (1 - 6 years)	HQ
Arsenic	3E-04	0.0026	4E-05	1E-01	NA		NA	
Iron	0.3	2.03	3E-02	9E-02	NA		NA	
Manganese	0.14	0.141	2E-03	1E-02	NA		NA	
Thallium	8E-05	0.0056	8E-05	1E+00	NA		NA	
			SUM-->	1.0	**SUM-->**		**SUM-->**	

ADD = Average Daily Dose
HQ = Hazard Quotient
NA = Not Applicable. Incidental Ingestion of Surface Water by the Youth and Child Trespasser is not quantitatively estimated; please see text for further details.

Table 10. Quantitative Risk Assessment - Carcinogenic

Commercial/Industrial Use - Ingestion/Surface Water

Chemical	q1*	Surface Water [ ] Max (mg/l)	LADD Adult Worker	CR	LADD Youth Trespasser (6 - 17 years)	CR	LADD Child Trespasser (1 - 6 years)	CR
Arsenic	1.5	0.0026	1E-05	2E-05	NA		NA	
			SUM-->	2E-05	**SUM-->**		**SUM-->**	

ADD = Average Daily Dose
HQ = Hazard Quotient
NA = Not Applicable. Incidental Ingestion of Surface Water by the Youth and Child Trespasser is not quantitatively estimated; please see text for further details.
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Gilbert Tank Farm - Parcel 472

Table 11. Quantitative Risk Assessment - Noncarcinogenic

Commercial/Industrial Use - Incidental Ingestion/Sediment

Chemical	RfD	Sediment [ ] Max (mg/kg)	ADD Adult Worker	HQ	ADD Youth Trespasser (6 - 17 years)	HQ	ADD Child Trespasser (1 - 6 years)	HQ
Aluminum	1	14500	1E-03	1E-03	4E-03	4E-03	2E-02	2E-02
Arsenic	0.0003	8.6	9E-07	3E-03	2E-06	8E-03	1E-05	4E-02
Beryllium	0.005	2.1	2E-07	4E-05	6E-07	1E-04	3E-06	6E-04
Iron	0.3	32600	3E-03	1E-02	9E-03	3E-02	4E-02	1E-01
Manganese	0.14	2050	2E-04	1E-03	5E-04	4E-03	3E-03	2E-02
Benzo[g,h,i]perylene*	0.03	0.098	1E-08	3E-07	3E-08	9E-07	1E-07	4E-06
Fluoranthene	0.04	0.33	3E-08	8E-07	9E-08	2E-06	4E-07	1E-05
Phenanthrene*	0.03	0.1	1E-08	3E-07	3E-08	9E-07	1E-07	4E-06
Pyrene	0.03	0.25	3E-08	8E-07	7E-08	2E-06	3E-07	1E-05
			SUM-->	0.02	**SUM-->**	0.04	**SUM-->**	0.2

ADD = Average Daily Dose
HQ = Hazard Quotient
* = Toxicity Data for Pyrene, a Structurally Similar Analogue, Were Used

Table 12. Quantitative Risk Assessment - Carcinogenic

Commercial/Industrial Use - Incidental Ingestion/Sediment

Chemical	q1*	Sediment [ ] Max (mg/kg)	LADD Adult Worker	CR	LADD Youth Trespasser (6 - 17 years)	CR	LADD Child Trespasser (1 - 6 years)	CR
Arsenic	1.5	8.6	3E-07	5E-07	4E-07	6E-07	1E-06	1E-06
Beryllium	4.3	2.1	8E-08	3E-07	1E-07	4E-07	2E-07	1E-06
PAHs	7.3	0.22	8E-09	6E-08	1E-08	7E-08	3E-08	2E-07
			SUM-->	9E-07	**SUM-->**	1E-06	**SUM-->**	3E-06

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Gilbert Tank Farm - Parcel 472

Table 13. Quantitative Risk Assessment - Noncarcinogenic

Background

Residential Use - Incidental Ingestion/Soil

Chemical	RfD	Soil [ ] Max (mg/kg)	ADD Adult Resident	HQ	ADD Youth Resident (6 - 17 years)	HQ	ADD Child Resident (1 - 6 years)	HQ
Aluminum	1	8870	1E-02	1E-02	2E-02	2E-02	1E-01	1E-01
Arsenic	0.0003	4	5E-06	2E-02	1E-05	3E-02	5E-05	2E-01
Beryllium	0.005	0.65	9E-07	2E-04	2E-06	3E-04	8E-06	2E-03
Iron	0.3	15200	2E-02	7E-02	4E-02	1E-01	2E-01	6E-01
Manganese	0.14	348	5E-04	3E-03	8E-04	6E-03	4E-03	3E-02
Benzo[g,h,i]perylene*	0.03	0.13	2E-07	6E-06	3E-07	1E-05	2E-06	5E-05
Fluoranthrene	0.04	0.2	3E-07	7E-06	5E-07	1E-05	2E-06	6E-05
Phenanthrene*	0.03	0.071	1E-07	3E-06	2E-07	6E-06	9E-07	3E-05
Pyrene	0.03	0.19	3E-07	9E-06	5E-07	2E-05	2E-06	8E-05
			SUM-->	0.1	**SUM-->**	0.2	**SUM-->**	0.9

ADD = Average Daily Dose
HQ = Hazard Quotient

* = Toxicity Data for Pyrene, a Structurally Similar Analogue, Were Used

Table 14. Quantitative Risk Assessment - Carcinogenic

Background

Residential Use - Incidental Ingestion/Soil

Chemical	q1*	Soil [ ] Max (mg/kg)	LADD Adult Resident	CR	LADD Youth Resident (6 - 17 years)	CR	LADD Child Resident (1 - 6 years)	CR
Arsenic	1.5	4	2E-06	4E-06	2E-06	2E-06	4E-06	6E-06
Beryllium	4.3	0.65	4E-07	2E-06	3E-07	1E-06	7E-07	3E-06
PAHs	7.3	0.3	2E-07	1E-06	1E-07	9E-07	3E-07	2E-06
			SUM-->	6E-06	**SUM-->**	4E-06	**SUM-->**	1E-05

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Gilbert Tank Farm - Parcel 472

Table 15. Quantitative Risk Assessment - Noncarcinogenic

Background

Residential Use - Ingestion/Surface Water

Chemical	RfD	Surface Water [ ] Max (mg/l)	ADD Adult Resident	HQ	ADD Youth Resident (6 - 17 years)	HQ	ADD Child Recreational User (1 - 6 years)	HQ
Iron	0.3	1.97	5E-02	2E-01	5E-02	2E-01	1E-01	4E-01
Manganese	0.14	0.143	4E-03	3E-02	3E-03	2E-02	9E-03	6E-02
			SUM-->	0.2	**SUM-->**	0.2	**SUM-->**	0.5

ADD = Average Daily Dose
HQ = Hazard Quotient

Table 16. Quantitative Risk Assessment - Noncarcinogenic

Background

Residential Use - Incidental Ingestion/Sediment

Chemical	RfD	Sediment [ ] Max (mg/kg)	ADD Adult Resident	HQ	ADD Youth Resident (6 - 17 years)	HQ	ADD Child Resident (1 - 6 years)	HQ
Aluminum	1	1210	1E-04	1E-04	3E-04	3E-04	2E-03	2E-03
Arsenic	0.0003	2.6	3E-07	9E-04	7E-07	2E-03	3E-06	1E-02
Beryllium	0.005	1.1	1E-07	2E-05	3E-07	6E-05	1E-06	3E-04
Iron	0.3	22000	2E-03	7E-03	6E-03	2E-02	3E-02	1E-01
Manganese	0.14	851	9E-05	6E-04	2E-04	2E-03	1E-03	8E-03
Fluoranthene	0.04	0.15	2E-08	4E-07	4E-08	1E-06	2E-07	5E-06
Pyrene	0.03	0.13	1E-08	4E-07	3E-08	1E-06	2E-07	6E-06
			SUM-->	0.009	**SUM-->**	0.02	**SUM-->**	0.1

ADD = Average Daily Dose
HQ = Hazard Quotient
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Gilbert Tank Farm - Parcel 472

Table 17. Quantitative Risk Assessment - Carcinogenic

Background

Residential Use - Incidental Ingestion/Sediment

Chemical	q1*	Sediment [ ] Max (mg/kg)	LADD Adult Resident	CR	LADD Youth Resident (6 - 17 years)	CR	LADD Child Resident (1 - 6 years)	CR
Arsenic	1.5	2.3	1E-07	2E-07	1E-07	2E-07	3E-07	4E-07
Beryllium	4.3	0.15	7E-09	3E-08	7E-09	3E-08	2E-08	7E-08
PAHs	7.3	0.15	7E-09	5E-08	7E-09	5E-08	2E-08	1E-07
			SUM-->	2E-07	**SUM-->**	2E-07	**SUM-->**	6E-07

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk

Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Table 18. PAH Relative Potency Concentrations
Parcel 472 - Sediment

Chemical	Soil Concentration (mg/kg)	Relative Potency Factor	Relative Concentration (mg/kg)
Benz[a]anthracene	0.18	0.1	0.018
Benzo[b]fluoranthene	0.28	0.1	0.028
Benzo[k]fluoranthene	0.23	0.01	0.0023
Benzo[a]pyrene	0.16	1	0.16
Chrysene	0.17	0.001	0.00017
Indeno[1,2,3-cd]pyrene	0.084	0.1	0.0084
		SUM-->	0.22

Table 19. PAH Relative Potency Concentrations
Background - Soil

Chemical	Soil Concentration (mg/kg)	Relative Potency Factor	Relative Concentration (mg/kg)
Benz[a]anthracene	0.16	0.1	0.016
Benzo[b]fluoranthene	0.34	0.1	0.034
Benzo[k]fluoranthene	0.27	0.01	0.0027
Benzo[a]pyrene	0.19	1	0.19
Chrysene	0.17	0.001	0.00017
Dibenz[a,h]anthracene	0.045	1	0.045
Indeno[1,2,3-cd]pyrene	0.1	0.1	0.01
		SUM-->	0.30

Table 20. PAH Relative Potency Concentrations
Background - Sediment

Chemical	Soil Concentration (mg/kg)	Relative Potency Factor	Relative Concentration (mg/kg)
Benz[a]anthracene	0.1	0.1	0.01
Benzo[b]fluoranthene	0.15	0.1	0.015
Benzo[k]fluoranthene	0.15	0.01	0.0015
Benzo[a]pyrene	0.12	1	0.12
Chrysene	0.12	0.001	0.00012
		SUM-->	0.15

Table 21. Quantitative Risk Assessment

Residential Exposure Scenario - Noncarcinogenic Risk

Chemical	Soil	Surface Water	Sediment	Risk From Exposure to Contaminant in All Media
Adult Resident				
Aluminum	1E-02		2E-03	1E-02
Arsenic	2E-02	2E-01	3E-03	3E-01
Beryllium	2E-04		4E-05	3E-04
Iron	2E-01	2E-01	1E-02	4E-01
Manganese	5E-03	3E-02	2E-03	3E-02
Thallium		2E+00		2E+00
Benzo[g,h,i]perylene			3E-07	3E-07
Fluoranthene			8E-07	8E-07
Phenanthrene			3E-07	3E-07
Pyrene			9E-07	9E-07
Risk From Exposure to All Contaminants in a Medium	0.2	2	0.02	
Youth Resident				
Aluminum	2E-02		4E-03	3E-02
Arsenic	4E-02	2E-01	8E-03	3E-01
Beryllium	4E-04		1E-04	5E-04
Iron	4E-01	2E-01	3E-04	5E-01
Manganese	8E-03	2E-02	4E-03	4E-02
Thallium		2E+00		2E+00
Benzo[g,h,i]perylene			9E-07	9E-07
Fluoranthrene			2E-06	2E-06
Phenanthrene			9E-07	9E-07
Pyrene			2E-06	2E-06
Risk From Exposure to All Contaminants in a Medium	0.4	2	0.02	

Shading indicates that population exceeds the USEPA recommended Hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Table 21 (Continued). Quantitative Risk Assessment

Residential Exposure Scenario - Noncarcinogenic Risk

Chemical	Soil	Surface Water	Sediment	Risk From Exposure to Contaminant in All Media
Child Resident				
Aluminum	1E-01		2E-02	1E-01
Arsenic	2E-01	5E-01	4E-02	8E-01
Beryllium	2E-03		6E-04	3E-03
Iron	2E+00	4E-01	2E-01	2E+00
Manganese	4E-02	6E-02	2E-02	1E-01
Thallium		4E+00		4E+00
Benzo[g,h,i]perylene			4E-06	4E-06
Fluoranthene			2E-06	2E-06
Phenanthrene			9E-07	9E-07
Pyrene			2E-06	2E-06
Risk From Exposure to All Contaminants in a Medium	2	5	0.2	
Residential Exposure Scenario - Carcinogenic Risk				
Adult Resident				
Arsenic	4E-06	5E-05	6E-07	5E-05
Beryllium	2E-06		4E-07	2E-06
Carcinogenic PAHs			7E-08	7E-08
Risk From Exposure to All Contaminants in a Medium	6E-06	5E-05	1E-06	
Youth Resident				
Arsenic	3E-06	2E-05	6E-07	2E-05
Beryllium	2E-06		4E-07	2E-06
Carcinogenic PAHs			7E-08	7E-08
Risk From Exposure to All Contaminants in a Medium	5E-06	2E-05	1E-06	

Shading indicates that population exceeds the USEPA recommended Hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Table 21 (continued). Quantitative Risk Assessment

Residential Exposure Scenario - Carcinogenic Risk

Chemical	Soil	Surface Water	Sediment	Risk From Exposure to Contaminant in All Media
Child Resident				
Arsenic	8E-06	2E-05	1E-06	3E-05
Beryllium	4E-06		1E-06	5E-06
Carcinogenic PAHs			2E-07	2E-07
Risk From Exposure to All Contaminants in a Medium	1E-05	2E-05	2E-06	
Commercial/Industrial Exposure Scenario - Noncarcinogenic Risk				
Adult Worker				
Aluminum	5E-03		2E-03	6E-03
Arsenic	8E-03	1E-01	3E-03	1E-01
Beryllium	9E-05		4E-05	1E-04
Iron	7E-02	9E-02	1E-02	2E-01
Manganese	2E-03	1E-02	2E-03	2E-02
Thallium		1E+00		1E+00
Benzo[g,h,i]perylene			3E-07	3E-07
Fluoranthene			8E-07	8E-07
Phenanthrene			3E-07	3E-07
Pyrene			9E-07	9E-07
Risk From Exposure to All Contaminants in a Medium	0.09	1	0.02	

Shading indicates that population exceeds the USEPA recommended Hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Table 21 (continued). Quantitative Risk Assessment

Commercial/Industrial Exposure Scenario - Noncarcinogenic Risk

Chemical	Soil	Surface Water	Sediment	Risk From Exposure to Contaminant in All Media
Youth Trespasser				
Aluminum	9E-03		4E-03	1E-02
Arsenic	2E-02		8E-03	2E-02
Beryllium	2E-04		1E-04	3E-04
Iron	1E-01		3E-02	2E-01
Manganese	3E-03		4E-03	7E-03
Benzo[g,h,i]perylene			9E-07	9E-07
Fluoranthene			2E-06	2E-06
Phenanthrene			9E-07	9E-07
Pyrene			2E-06	2E-06
Risk From Exposure to All Contaminants in a Medium	0.2		0.04	
Child Trespasser				
Aluminum	4E-02		2E-02	6E-02
Arsenic	8E-02		4E-02	1E-01
Beryllium	8E-04		6E-04	1E-03
Iron	7E-01		2E-01	8E-01
Manganese	2E-02		2E-02	4E-02
Benzo[g,h,i]perylene			4E-06	4E-06
Fluoranthene			1E-05	1E-05
Phenanthrene			5E-06	5E-06
Pyrene			1E-05	1E-05
Risk From Exposure to All Contaminants in a Medium	0.8		0.2	
Commercial/Industrial Exposure Scenario - Carcinogenic Risk				
Adult Worker				
Arsenic	2E-06	2E-05	5E-07	2E-05
Beryllium	1E-07		3E-07	4E-07
Carcinogenic PAHs			6E-08	6E-08
Risk From Exposure to All Contaminants in a Medium	2E-06	2E-05	9E-07	
Youth Trespasser				
Arsenic	3E-06		6E-07	4E-06
Beryllium	2E-07		4E-07	6E-07
Carcinogenic PAHs			7E-08	7E-08
Risk From Exposure to All Contaminants in a Medium	3E-06		1E-06	

Shading indicates that population exceeds the USEPA recommended Hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Table 21 (continued). Quantitative Risk Assessment

Commercial/Industrial Exposure Scenario - Noncarcinogenic Risk

Chemical	Soil	Surface Water	Sediment	Risk From Exposure to Contaminant in All Media
Child Trespasser				
Arsenic	3E-06		1E-06	4E-06
Beryllium	1E-07		1E-06	1E-06
Carcinogenic PAHs			2E-07	2E-07
Risk From Exposure to All Contaminants in a Medium	3E-06		2E-06	

Shading indicates that population exceeds the USEPA recommended Hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

APPENDIX D - PICTURES